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INFORMATION ON INTERNATIONAL GEOPHYSICAL COOPERATION -- SOVIET-BLOC ACTIVITIES

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I. UPPER ATMOSPHERE

Review of a Soviet Publication: "Solar Activity and Its Influence on the Ionosphere"

Typical of the vast array of scientific literature published in the USSR is a new 31-page pamphlet on the influence of solar activity on the state of the ionosphere. While only containing information that is basic to ionospheric specialists, it represents a brief and coherent presentation of the subject matter for the nonspecialist or general public. The headings of the various sections give some indication of the scope of the publication: The Nature of Solar Radiation; Laws Governing the Exposure of the Earth's Surface to the Sun; Ionizing Action of Solar Radiation in the Earth's Atmosphere; The Influence of the Earth's Magnetic Field on the Distribution of Ionization; General Structure of the Sun; Active Regions on the Sun; Radiation of Active Regions on the Sun and Disturbances in the Ionosphere; The Eleven-Year Cycle of Solar Activity; State of the Ionosphere and Conditions Affecting Short-Wave Radio Communications. ("Solar Activity and Its Influence on the Ionosphere," by N. Ya. Bugoslavskaya, State Publishing House for Literature on Problems of Communications and Radio, Moscow, 1959, 31 pages, 12,150 copies printed)

The Operation of the "Sun Service" in the USSR

The following is the full text of a brief description of the observation program conducted by the Soviet "Sun Service":

Systematic observations of the condition and activity of the Sun are being made by the "Sun Service" in the USSR and throughout the world.

The "Sun Service" engages in the following observations:

1. A daily recording of solar activity by the number and area of spots, the area and intensity of flares and flocculi, the number of prominences and dark filaments and their size, and the intensity of the inner parts of the Sun's corona. Modern apparatus makes it possible to observe that part of the corona closest to the Sun without there being an eclipse.

2. Observations of active phenomena of short duration (outbursts, eruptions) insofar as possible on a 24-hour basis.

3. The drawing of synoptic maps of the Sun for each of its rotations on its axis.

On the basis of such observations it is possible to make short- and long-range predictions of the Sun's activity and its influence on radio communications.

A great number of astronomical observatories in the USSR participate in the "Sun Service." In the course of the IGY and IGC programs

there has been an expansion in the program of solar observations and observatories have been supplied with new equipment. Hours for the observation of brief phenomena have been allotted among the various observatories.

The results of solar observations in the USSR are printed in the bulletin "Solar Data," published by the Academy of Sciences of the USSR. During the International Geophysical Year solar data are transmitted by radio together with meteorological and ionospheric data (0910-0925 hours Moscow Legal Time on wavelengths 30.4 m and 56.2 m and 2010-2025 hours on wavelength 30.4 m). ("Sun Service," Appendix to the book "Solar Activity and Its Influence on the Ionosphere" /Briefly reviewed in the preceding article/)

Academician Barabashov Reviews Our Current Knowledge on the Planet Venus

Academician Barabashov, outstanding Ukrainian astronomer, has written an outstanding article in a recent issue of the popular Soviet publication Tekhnika Molodezhi on the present status of our knowledge of Venus. The article runs approximately 4,000 words and is a thorough, authoritative, and interesting account; although appearing in a periodical meant for popular consumption, the account is far superior to what is readily available in many American encyclopedias. Barabashov makes it clear that the Soviets regard Mars and Venus as the prime targets of forthcoming space exploration. ("Venus, Take Off Your Mask," by Acad. N. Barabashov, Tekhnika Molodezhi, No. 4, 1960, pages 14-17)

Absorption of Radioradiation in the Magnetic Storm of 15 July 1959

A brief 400-word report by two scientists at the Radiophysical Scientific Research Institute at Gor'kiy University deals with the absorption of radioradiation during a magnetic storm of 15 July 1959. ("Absorption of Cosmic Radioradiation During a Magnetic Storm of 15 July 1959," by Ye. A. Benediktov and Yu. S. Korobkov, Izvestiya Vysshikh Uchebnykh Zavedeniy, Vol. III, No. 2, 1960 /Radiophysics Series/)

Life on Mars

Following are excerpts from an unsigned article in the Ukrainian-language periodical Znannya ta Pratsya (Knowledge and Work), No. 6, 1960.

It is interesting to follow through a telescope the changes in the coloring of the planet depending on the season.... Such phenomena have given us reason to believe that the dark colorings are signs of plant life....

In 1956 Sinton made the first spectrographic analysis of Mars, using the Harvard Observatory telescope.... In November 1958 Sinton repeated his experiment at Palomar Observatory. This gave Sinton and other scientists reason to conclude that life exists on Mars....

Our photos bring out the dynamics of changes of one of the areas of Mars near the so-called Cimmerian Sea from 1909 to 1958. We can see here certain changes in that segment such as the creation of new "canals."

WHAT IS THE OPINION OF OUR SCIENTISTS?

In 1956 the well-known Soviet geophysicist Professor Lebedinskiy stated that water vapor does not exist in the atmosphere of Mars, regardless of the presence of moisture on that planet. Hence it is quite probable that the water there is in the form of underground ice and that the amount is certainly quite great.

There is reason to assume that during "marsquakes" (by analogy with earthquakes) the intactness of the ice cover is destroyed; fissures appear through which water bubbles; at first the water evaporates into the atmosphere and later condenses. The nature of this phenomenon can apparently be explained by the mysterious streaks along the canals mentioned by Academician Barabashov as early as 1924. Such an extensive icy hydrosphere also explains the absence of high mountain areas.

Along the cracks in the ice cover climatic conditions must be very mild. And if this is so there may also be vegetation. Segments covered with vegetation and observed at a great distance may appear to be regular solid lines.

This then is certainly the real nature of the "canals" of Mars. ("Life on Mars," Znannya ta Pratsya, No. 6, 1960, page 19)

II. METEOROLOGY

The Use of a Spherical Mirror in Photographing the Cloud Cover of the Full Sky

The photographic method is one of the most suitable procedures for the systematic study of the movement and development of clouds. It gives a clear idea of the character of the cloud cover in various parts of the sky and the way in which it changes.

The author of the article under review points out that when using an ordinary movie camera, even when using a wide-angle lens, it is possible to photograph only a small part of the sky. It is often important to know, he adds, what the condition of the entire sky is, especially when the situation is rapidly changing. Because it has been necessary to take a large number of photographs for this purpose it has been desirable to find a method to get an image of the entire sky in a single photograph.

This article reviews the efforts made in the past to solve this problem, and proceeds to a discussion of the use of a spherical mirror. The author describes such a mirror and associated apparatus used in the

Soviet Union in 1957-1958 during work in Crimea and in the Caucasus. The article is accompanied by the numerous formulae used in conjunction with the method. ("Experimentation with the Observation of Clouds by the Photographic Method Using a Spherical Mirror," by T. N. Bibikova, Vestnik Moskovskogo Universiteta, Seriya III, Fizika-Astronomiya, No. 2, 1960, pages 5-11)

Abstracts of Articles from the Latest Issue of "Meteorologiya i Gidrologiya" (No. 7, 1960)

"The Influence of Relief on the Displacement of Pressure Centers," by A. S. Dubov, pages 3-8.

A great deal of attention has been devoted in recent works to the hydrodynamic method of prediction of the pressure field, with due allowance for the influence exercised by the underlying surface. Dubov endeavors in this article to limit the problem to the influence of the underlying surface on pressure centers only; he cites the necessary approach and proposes the formulae needed for the solution of his more limited problem.

"On the Possible Causes of Changes in Solar and Atmospheric Relationships," by L. A. Vitel's, pages 9-13.

Vitel's points out that the relationship between solar activity and atmospheric phenomena has long been a riddle. He conjectures in this article that there is an important correlation between such geophysical phenomena as magnetic storms and such meteorological phenomena as the circulation of the atmosphere and proceeds to expand considerably on this theme.

"Synoptic Data for the Testing of Statistical Methods of Prediction," by M. I. Yudin, pages 22-25.

Experimentation with statistical predictions of the pressure field have shown that the degree of success in prediction changes greatly from day to day and is different in different areas. Therefore the comparison of different methods and variants of statistical prediction for the purpose of discovering their merits and shortcomings should be based on the same synoptic material, the same basic data. This article is a summary of the report of a working group which has proposed a method for conducting such tests.

III. OCEANOGRAPHY

Still Another Research Vessel Leaves the Leningrad Shipyards

The following is the full text of a news dispatch published in Izvestiya:

Leningrad. 21 July (by telephone from our correspondent). The scientific research vessel "Petr Lebedev," with a displacement of 4,500 tons, has set sail from its moorings at the A. A. Zhdanov Shipyards at Leningrad for a test run at sea.

The ship carries the most modern navigational and radiotechnical equipment and various kinds of hydrogeological, oceanographic, and hydrobiological instruments and observation equipment; thus equipped the vessel can explore the deepest parts of the world ocean.

Several days earlier a similar diesel-powered vessel named the "Sergey Vavilov" set sail for a test run at sea.

Soviet scientists will soon receive excellent ships. ("The Fleet of Science Ships Is Increasing," Izvestiya, 22 July 1960, page 3)

A Method for Calculating the Temperature of Sea Water Under Certain Conditions

An article appearing in the latest issue of the journal Meteorologiya i Gidrologiya discusses the exceedingly complex nature of vertical distribution of temperature with depth in the waters of the ocean and provides a complex method for computing the desired values. The article is accompanied by a bibliography of the literature consulted. ("A Method for Calculating the Temperature of Water in the Upper Layer of the Sea During the Warm Season of the Year," by N. A. Belinskiy and M. G. Glagoleva, Meteorologiya i Gidrologiya, No. 7, 1960, pages 14-21)

IV. ARCTIC AND ANTARCTIC

Summary of Antarctic Conditions and Activities for July 1959

The following is the full text of a report for the month of July 1959 by A. G. Dralkin, Chief of the Fourth Continental Expedition:

Mirnyy Observatory:

Aerometeorological research: The mean values at the Earth's surface in July 1959 were: atmospheric pressure 984 mb, air temperature - 17.1°, wind velocity 11.8 m/sec, relative humidity 75%. Over-all cloudiness 6.2. The mean height reached by radiosondes was 16,287 m. During the month the air temperature varied from - 3.6° to - 34.7°. The total precipitation in July was 63.8 mm. Maximum wind velocity attained 40 m/sec.

Zonal circulation of the atmosphere predominated in July. A cold and nearly stagnant low was observed over the coastal part of the mainland; cyclones moved from west to east along the periphery of this low. On two occasions the formation of a high subantarctic ridge was noted.

During the first and second 10-day periods easterly winds predominated throughout the troposphere. At the end of the first 10-day period, as a result of the merging of a powerful Australian anticyclone with the Antarctic ridge, the easterly wind in the vicinity of Wilkes Land intensified and in the second 10-day period its velocity attained its maximum values: 70-80 m/sec. Beginning in the middle of the second 10-day period, evidently in connection with the movement of the high Antarctic anticyclone, the strong easterly winds in the vicinity of Wilkes Land changed to southerly winds with velocities of 30-60 m/sec. At the same time jet streams of this same direction were observed in the lower stratosphere; at this time a second tropopause was observed at a height of 18 km with a temperature gradient of more than 0.4°. With the approach of an occluded cold cyclone the height of the tropopause changed from 15 to 9 km, while the winds in the lower stratosphere and troposphere took on a westerly direction. Their velocity in the troposphere decreased to 4-16 m/sec. The winds maintained an easterly direction in the lower 1 1/2-km layer.

The weather at the beginning of the third 10-day period was heavily influenced by the nearly stagnant occluded cyclones. Jet streams of a westerly direction were observed at great altitudes in the lower stratosphere. Wind velocity in the troposphere did not exceed 20 m/sec. The altitude of the tropopause varied in the range from 10 to 11 km.

At the end of the third 10-day period the development of a high subantarctic anticyclone was observed; the tropopause rose to a height of 14.5 km, where the velocity of the southwesterly wind was 60 m/sec. A thick near-surface inversion was observed.

With the appearance of a southwesterly stratospheric jet stream the upper tropopause was again observed at an altitude of about 18 km.

Geophysical research. In the first 10-day period the magnetic field was extremely calm. On 11 July the first half of the day was marked by high activity, but at 1626 hours a magnetic storm began suddenly, attaining a greater intensity on the 12th. The amplitudes of the variations: for declination -- 1,150 γ, for the horizontal component -- 960 γ, for the vertical component -- 2,000 γ. At 0500 hours on 15 July activity began to increase and by 0800 hours the amplitudes had attained 2,300 γ for declination, 1,600 γ for the horizontal component, and 2,750 γ for the vertical component. The storm began to calm down on the 16th but developed with new strength after 1600 hours on 17 July. At that time the amplitudes were 1,175 γ, 1,455 γ, and 2,890 γ respectively. In the third 10-day period there were no storms but activity continued high. Brief new flare-ups of activity were observed almost every day.

In the first 10-day period the ionosphere was calm. Minimum frequencies did not exceed 2 mc; the E-layer made a regular appearance, although its critical frequencies did not exceed 2.2 mc. The critical frequencies of the F2 layer attained 10 mc. The sporadic layer was almost continuously present.

At 0500 hours on 10 July the minimum frequencies began to increase and divergent absorption began to increase at the same time. At 0900 hours complete absorption began but an hour later there was again an increase in the minimum frequencies and divergent absorption. The complete absorption setting in thereafter continued with an interruption of no more than an hour until 1000 hours on 19 July. The F2 layer then appeared, but its critical frequencies could not be determined due to strong divergent absorption and high minimum frequencies.

Beginning on 21 July the ionosphere became markedly calmer, but minimum frequencies at noonday remained high up to the end of the month.

Visual and photographic observations were made of auroras.

Fifty-one earthquakes were recorded; some occurred at the very great depth of 600 to 650 km.

Glaciological research: Thirty-two structural analyses were made of shelf ice, glacial ice and marine ice. Systematic observations continued of readings of thermo-gradient apparatus on ice along the shore. Thermometers were prepared and inserted into continental ice and ice along the shore. Remote-control automatically recording thermometers were installed on shore ice, with continual automatic recording beginning on 16 July.

Vostok Station:

In May the mean values at the Earth's surface were: atmospheric pressure -- 623.4 mb, air temperature -- - 68.4°, wind velocity 5.6 m/sec, relative humidity -- 73%, temperature of the snow surface -- - 70.4°. Over-all cloudiness was 3.2. Observations were made of the density and temperature of the snow cover. The mean density of the snow at a depth of 10 cm was 0.34 g/cm^3, at a depth of 50 cm -- 0.36, at a depth of 100 cm -- 0.35. The mean temperature of the snow at a depth of 10 cm was - 66.8°, at a depth of 50 cm -- - 66.7°, and at a depth of 100 cm -- - 65°.

The aerologists sent 31 radiosondes aloft and made a similar number of observations of radiosondes by radiotheodolite. The mean altitude reached by radiosondes was 14,791 m; the maximum was 17,790 m. The mean height for pilot balloon observations was 14,470 m. During the entire month there was a deep near-surface inversion with an increase in temperature to - 38° at the 3,700-4,200 m level. The mean value for the isobaric surface levels reveals virtually no change in comparison with the preceding month. A further insignificant drop of the temperature in the troposphere and stratosphere was noted.

The state of the ionosphere in July was characterized by some decrease in the critical frequencies in the F2 layer and an increase in the thickness of the E layer, especially toward the end of the month.

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From the 10th through the 19th of July observers noted a complete absorption of radiowaves, accompanied by a magnetic storm and auroras. The change from a calm state to complete absorption took place in the course of a few hours.

Auroras were photographed on a round-the-clock schedule.

Lazarev Station:

In July the mean values at the Earth's surface were: atmospheric pressure -- 984.0 mb, air temperature -- - 21.4°, wind velocity -- 15.6 m/sec, relative humidity -- 78%, total precipitation -- 15.7 mm. Overall cloudiness was 7.1. Winds of an east-southeast direction predominated. During the month there were 20 days with winds of storm force, and 11 days with winds of hurricane force. The last days of the month were marked by a snowfall and howling winds of hurricane force.

The mean density of the snow during two 10-day periods was 0.40 g/cm^3. On the night of 30-31 July colored precipitation was observed (rod-shaped snow crystals with a reddish-brown color). Aerologists released 24 radiosondes; the maximum height attained was 18,670 m. ("By Radio From Antarctica," by A. G. Dralkin, Informatsionny Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii, No. 13, 1959, pages 41-43)

Abstracts of Articles Appearing in Issue #13 of the "Bulletin of the Soviet Antarctic Expedition"

Issue #13 of the Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspedit... contains eight articles of interest to geophysicists, as follows:

1. "On the Accumulation of the Snow Cover in the 50-km Coastal Zone of Antarctica," by V. M. Kotlyakov (Institute of Geography of the Academy of Sciences), pages 5-8.

Much of the data in this article applies to two observation points, one at Mirnyy, and another at a distance of 7 km from the shore. Generalizations, however, are made for a distance of as much as 50 km inland. The article gives data on seasonality, depth, and variability in snow accumulation, and in part accounts for local differences.

2. "Automatic Apparatus for Recording the Moistening Level," by M. A. Kuznetsov (Permafrost Institute of the Academy of Sciences), pages 9-11.

This article, accompanied by one diagram, describes a simple but superior device for determining the height of capillary rise of water in snow.

3. "On the Nature of Several Weather Changes Over the Antarctic Plateau in Winter," by P. D. Astapenko (Leningrad Hydrometeorological Institute), pages 12-16.

Observational data for the Antarctic plateau during the period of the IGY show that the weather there is subject to considerable changes during the year. It is possible to observe rather sharp

changes in temperature, wind, cloud cover, precipitation and visibility at the interior stations, distant from the coast and situated at elevations between 1,500 and 3,500 m. This article points out that vertical cross sections of the atmosphere are very useful in studying the weather in this area, especially due to the sparsity of stations in the interior. Figure 1 is a vertical cross section of the atmosphere over the Amundsen-Scott Station in August 1958. Figure 2 is a similar cross section for the preceding month. Figure 3 is a full page fold-out map of synoptic conditions at 0000 hours on 28 July 1958. Figure 4 is a vertical cross section of the atmosphere for the Amundsen-Scott Station for June of 1958. These figures are used by the author as a basis for elaborating his point that such materials are highly valuable for understanding the weather picture in this area with few reporting stations.

4. "Evaporation and Condensation in Antarctica," by N. P. Rusin (Main Geophysical Observatory), pages 17-20.

One of the characteristics of the climate of Antarctica is the presence of pronounced near-surface inversions; these are observed over the mainland for a large part of the year. Because of this the near-surface layer of air is almost everywhere not only warmer than the underlying surface, but is more moist as well. This causes a continual flux of moisture from the atmosphere and its sublimation on the underlying surface. The author of this article has endeavored to estimate the value for turbulent moisture exchange in the near-surface layer of air and the possible amount of precipitation resulting from sublimation.

5. "Snowstorms in Antarctica," by I. D. Kopanev (Main Geophysical Observatory), pages 21-24.

Systematic observations of snowstorms were made at the time of the Second Continental Expedition (1956-1958). Data in Table 1 show the areal differences in the number of days with snowstorms. With increasing distance from the coast this number decreases considerably. Local conditions may invalidate this generalization. In the Antarctic, as in the Arctic, snowstorms are observed throughout the year. The maximum number of days with snowstorms is in the cold season; this is due to cyclonic activity, greater wind velocities, and considerable values for turbulent friction.

Areal variability in the number of days with snowstorms, drifting snow, and the duration of same, is shown in Table 2; it reflects the characteristics of the wind regime and the physical-mechanical properties of the snow cover within the limits of the territory investigated.

6. "Results of Observations of Currents in the Area of the West Shelf Ice," by M. V. Izvekov (Arctic and Antarctic Scientific Research Institute), pages 25-28.

In September 1959 the hydrological team of the Third Continental Expedition made observations of currents to the north of the West Shelf Ice at a point with the coordinates 65°49' S and 87°47' E. Observations were made from the shelf ice where the sea was 472 m deep. The

fixed position of the shelf ice and the considerable depth created conditions for rather reliable observations of the distribution of currents (vertically) and changes in their constituents in time at the upper boundary of the continental slope in this region of Antarctica.

Alekseyev automatic current recorders were used to make continual observations of currents at depths of 100 and 460 m. Current constituents were recorded each five minutes. Graphs were drawn of the vertical distribution of currents at the point of observation (Figures 1 and 2). The results of these observations are fully described and interpreted.

7. "Radar Observations of Auroras at Mirnyy," by B. Ye. Bryunelli and S. M. Sandulenko (Fourth Continental Expedition), pages 29-33.

Radar observations of auroras were begun at Mirnyy in 1959. A P-3 radar set with rotating antenna was used for this purpose. The equipment and the accuracy of observations are given in some detail. The radar observations were fully automatic. Figure 1 shows that auroras for the most part are observed from 0400 to 2000 hours Greenwich Time. There are two clearly expressed maxima -- at 0500-0800 and 1200-1600 hours Greenwich Time. Figure 2 shows a sharply expressed asymmetry in the direction of arrival of signals. Figure 3 shows the distribution of auroras by distance; reflections most frequently arrive from distances of 650-750 km. The centers of auroras move at a velocity averaging 100-200 m/sec. The aspects of distance and direction are interpreted, this constituting the essential part of the article. The fact that most reflections are from the north is due to the fact that Mirnyy is situated to the south of the zone of auroras.

8. "Bottom Relief of the Cape Agulhas Basin," by V. N. Mal'tsev (Hydrographic Enterprise of the Main Administration of the Northern Sea Route), pages 38-39.

To the south of the Cape of Good Hope the continental shelf drops off sharply in a steep and highly dissected continental slope. Near 20° E it is 15 to 60 miles in width. The floor of the Indian Ocean to the south of Cape Agulhas begins at a distance of 150 miles from the coast of South Africa. Measurements made by Soviet Antarctic Expeditions in the years 1956-1959 in the Cape Agulhas Basin between 20° and 30° E have shown that the ocean floor in this area has very complex relief. The Cape Agulhas Basin is not a single extensive basin with depths greater than 5,000 meters, as shown on previous maps, but instead consists of two separate basins separated by an uplift from the ocean floor. (Figure 1 -- a map of the area). This uplift intersects the basin in a northeast-southwest direction and has a width of 90 to 210 miles. Whereas the part of the basin with depths greater than 5,000 m has a floor that has little dissection, the uplift separating the basins is highly dissected and abounds in volcanic structures. (Articles from Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii, No. 13, 1959, pages 5-33 and 38-39)

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